ALTA/ACSM Land Title Survey corner

—by Gary Kent

Q: *My question is about the proper way to calculate the relative positional accuracy on an ALTA/ACSM Land Title Survey. The formula I found on ACSM's website is 0.07 feet (or 20mm) + 50 ppm. The parcel that I am performing the Land Title Survey on has a total perimeter dimension of 786.00 feet. Would the correct calculation for the allowable RPA be this?*

*0.07 feet + (786.00 feet * 50/1,000,000) = 0.07 feet + 0.0393 feet = 0.1093 feet?*

Do you use the perimeter distance as above, or do you add in the distance from the Commencing point (a section corner in this case) to the point of beginning of the surveyed tract?

Is it safe to say that the corners most remote from each other will have the greatest RPA?

On my survey I found 4 iron pins that are shown as being in a straight line, but the one near my Northwest corner is actually 0.61 feet East of the line. The other 3 iron pins line up great. This is my greatest uncertainty, so would 0.61 feet be my RPA?

A: The relative positional accuracy (RPA) is between *any* point that was used to control a land boundary on the survey, relative to *any other point* that was used to control a land boundary. So the idea of determining the maximum allowable RPA for the survey by calculating it based on, for example, the perimeter of the tract is not correct. The calculation is, by definition, point-to-point specific. The allowable RPA is how much uncertainty, at the 95 percent confidence level, is allowable between the two specific points being checked.

Note, the standards say that this relationship is for *any* point on the survey relative to *any other* point on the survey. On a small survey, it's no big deal to check all of these combinations. On a large survey or network, it would be difficult and time consuming at best to check every possible combination of points. So, you would want to look for the worst cases.

The two points most remote from each other may have the largest RPA, although that is very much dependent on the procedures, equipment and circumstances involved in determining each of those locations. A combination of lower-accuracy equipment or a series of unbalanced or short sites used by necessity to reach some particular point "A" could result in the RPA associated with that point being the worst case, even though the point may not be as remote as some other point on the survey.

The RPA is calculated by a least squares adjustment that must accommodate the various primary elements that contribute to measurement uncertainty. These would include things such as how accurately can you set up the instrument over a point, how accurately can you site a target, and how accurately does your instrument read an angle. A person versed in least squares could make these calculations "by hand" on a simple survey. But as soon as some redundant measurements (or a combination of GPS and traditional measurements) are used, or if the survey includes a large number of points, the calculations will become too complicated for most to do by hand.

There are a number of least squares software programs available that will compute the uncertainty for the points on a survey. What is *allowable* uncertainty between any two points is 0.07 feet plus 50 ppm? This is based on the direct distance between the two specific points being checked—even if they are not connected by observation and are at opposite ends of the survey.

Whether or not the RPA between those two points passes the allowable RPA "test" is a function of an analysis in which the error ellipses at each point are used to compute a "relative error ellipse" for the relationship between those two points. The length of the semi-major axis of that relative error ellipse at 2 standard deviations is then compared against the 0.07 feet and 50 ppm between the same two points.

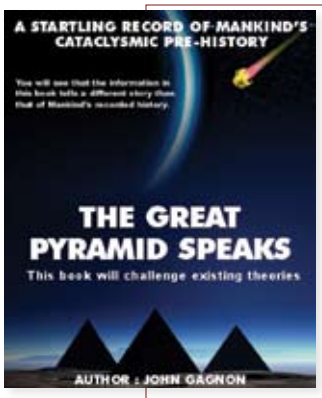
Most will want to use a computer program to make these calculations. This seems to annoy or bother many surveyors. However, if they use GPS—and it seems like most do these days—they use software every day to analyze results, propagate errors and create error ellipses. They don't seem to have a huge problem with that. Calculating RPA using a computer program is no different.

Your example of 0.61 feet off line has absolutely nothing whatsoever to do with RPA. The fact that it is off line means only … that it is off line (i.e., not where it was "supposed" to be! This might represent 0.61 feet of uncertainty as related to a question of *occupation* (if you are inclined to call a found monument evidence of occupation, which it often is), but it is not *measurement* of uncertainty. This issue is discussed in the introductory paragraph to the Accuracy Standards.

Granted there is some *small* amount of that 0.61 feet that *is* attributable to your measurements. This is what RPA is all about! In your situation, it is about this: You show the point being 0.61 feet off line. How much "uncertainty," at 2 standard deviations, is there in that 0.61 foot measurement due to your inability to measure perfectly? Least squares will tell you how much uncertainty there is; RPA tells us if that amount is acceptable.

Surveyors like to call themselves "Measurement Experts." This means more than being able to punch a button and get a supposedly precise measurement. A true measurement expert should be able to explain the integrity and sources of error in the measurements being made.

New book unlocks the secrets behind The Great Pyramid of Giza



In his new book "*The Great Pyramid Speaks*", author John Gagnon presents an astonishing new theory that The Great Pyramid of Giza marks a catastrophic meteor impact that occurred in 10,400BC and changed the history of Mankind forever.

The Great Pyramid speaks of horrendous impact(s) at Earth's northern pole and the dramatic movement of the entire continent of Africa. In order to show Africa's movement The Great Pyramid was built as a true representation of Earth's Northern Hemisphere. Within its walls are two chambers that were precisely constructed to mark the location of Giza before and after impact. The King's chamber is located one third the distance from the base to the top and represents Giza's present latitude, one third the distance from Earth's equator to it's north pole. The Queen's chamber represents Giza's latitude before impact and indicates that Africa shifted about 1000 miles northward as a result.

Within the scientific community it is an accepted fact that there is movement of the continents. The ongoing debate has always pertained to the type of movement. Has it been slowly over time or have there been sudden catastrophic movements? This book will weigh heavily into this debate by exploring evidence that a major impact event occurred just 12,400 years ago and, as a result, all continents were shifted great distances. This impact event was also responsible for the sudden end of the so-called "Ice Ages" and its related mass extinction event.

John Gagnon claims that the two star shafts associated with each of the two chambers within The Great Pyramid mark the same two stars as they would have been seen from Giza but at two vastly different times. This book will explain that star movement was precisely charted by the Ancients well before and long after this event. This vast knowledge was used by the Egyptians to record the amount of movement of Giza (Africa). It was also used to show the amount of change to Earth's Axis (Earth was knocked over). These movements within their world were forever locked within the four star shafts of The Great Pyramid. [The book can be reviewed at www.thegreatpyramidspeaks.com.]